

SpotLight

THE PEOPLE
WHO DRIVE
OUR SCIENCE
& TECHNOLOGY

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LAWRENCE LIVERMORE NATIONAL LABORATORY

TIME
FOR
CRAFTING



SpotLight

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WHO DRIVE
OUR SCIENCE
& TECHNOLOGY

INSIDE THIS ISSUE ● ● ●

Welcome to *SpotLight*, a look at the people who make up Lawrence Livermore National Laboratory. This edition, which typically appears in print form, is available on the web only due to the shelter-in-place in response to COVID-19.

With creativity, inspiration and a little science, several Lab employees have dabbled in home brewing to make beverages they can call their very own. Donald Loveland, Jeff Hittinger and Dan Laney have different techniques when it comes to brewing the perfect lager, IPA or stout; sometimes there's even a chance that they brew something different than expected.

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Christine Hartmann's life and the lives of others were significantly changed by a chance conversation in which she learned about some of the social and economic problems faced by millions of people worldwide who have intellectual or developmental differences, or disabilities. That encounter led her to help found an employee resource group that recognizes the capabilities of people whose brains work differently — people who are neurodiverse.

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Saptarshi Mukherjee has more than a knack for singing traditional Indian songs. Coming from a long line of musicians, he says he was trained in his art form since he was born. When he is singing, he connects to a tradition and legacy that are thousands of years old, and he looks forward to sharing his art with others who may not know about classical Indian music.

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We hope you enjoy this edition of *SpotLight*. We'd also like to hear from you. Send us your thoughts and suggestions, whether it's what you like — or even what you don't — about this magazine, or if there is something you would like to see in coming editions. You can reach us via email at pao@llnl.gov.

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On the cover

Jeff Hittinger and Dan Laney create home brew in Hittinger's back yard.



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THE ART OF THE CRAFT

By Jeremy Thomas

Lab employees apply creativity, inspiration and a little science to home brewing hobby

Donald Loveland starts the brewing process as he always does, with fresh whole grains. He weighs them carefully, grinds them into a powder and begins heating a large pot of water. Like making tea, he steeps the freshly milled grain in the hot “strike water,” activating the malt enzymes to break down the starches and pull sugars from the grain. The liquid extracted from this mashing process is the “wort” that will flavor his next beer.

After all the sugars are removed, Loveland boils the wort, adding hops and various ingredients depending on the style he’s creating. After an hour or two in the boil, the mixture is cooled down and transferred to a fermenter, where it sits for roughly two weeks. Then it’s ready to enjoy.

It sounds like a simple process, but to Loveland, proprietor of the (unofficial) Loveland Brewing Company, making craft beer is an art form, as well as a science.

“It’s ultimately a giant optimization process,” Loveland says. “You have this goal of hitting certain flavors with a specific alcohol percentage, and there are a hundred factors you can change to get to that target. There is a lot of room for scientific experimentation, but also a creative freedom which together make the process fun.”

Loveland began his hobby several years ago with an inexpensive, all-in-

one kit he got as a Christmas white elephant gift. He brought it back to his dorm at Cal Poly, San Luis Obispo, much to the delight of his roommates. Loveland recalls his first batch, an India Pale Ale he fermented under his bed, which was overly bitter and not received well by his friends. Undeterred, he tried again a few months later with a simpler ale that had less room for error and achieved much better results. Thus began his love affair with home brewing.

As he moved into his professional life, Loveland gradually upgraded his equipment, building a home-brew system in his apartment from scratch out of parts he found on Craigslist, and converting a mini fridge into a temperature-controlled fermentation tank.

About once a month, Loveland brews several gallons of beer at a time, keeping a meticulous log of his recipes so he can reproduce the ones he likes. Inspiration usually strikes the night before he starts a batch, and he crafts a recipe — a high alcohol dessert-type stout being a more recent preference for the holidays. Loveland says he can brew a decent beer for about \$25-\$30, which comes out to roughly 50 cents a pint. He keeps it kegged, so it stays fresh for a long time, and has a full tap system allowing for two beers on tap at a time.

“There is a constant chase of, ‘can I replicate and build upon some of the top beers that I really enjoy?’” Loveland says. “I’ll probably never say a recipe is done though. There’s always room for improvement, as there is with any hobby. The creative process keeps me going.”

As he starts to brew a new batch of beer, Lawrence Livermore National Laboratory computer scientist Donald Loveland heats and recirculates the “mash”— a combination of hot water and freshly milled grain — which will extract the grains’ sugars to create a fermentable liquid known as “wort.”

Photos by Julie Russell





The seasoned craftsman

Center for Applied Scientific Computing Director Jeff Hittinger’s interest in craft brewing began as a grad student with a taste for good beer, but its roots could be traced much earlier. Hittinger grew up in the shadow of America’s oldest brewery, Yuengling’s, in nearby Pottsville, Pennsylvania. Yuengling’s popular porter introduced Hittinger to beer outside the mainstream and led him to explore German and other non-American beers. Once, while vacationing with his wife in Bar Harbor, Maine, the lightbulb went off.

“I saw that a new local brewery had opened up, so I went on a tour and it was basically this guy’s basement,” Hittinger remembers. “He pulled out this dogeared copy of “The New Complete Joy of Home Brewing” — that’s how he started. That inspired me to try it myself.”

Armed with this bible of home brewing, Hittinger brewed his first batch and never looked back. Eventually, he joined the Ann Arbor Brewers’ Guild while at the University of Michigan, and with access to his department’s machine shop to help build custom home brewing gadgets — not to mention, plenty of eager taste testers — he got deep into exploring different styles and techniques. At the peak of production, he and a former classmate brewed about 10 different lagers in 10 weeks.

“It probably added two years to my grad school experience,” Hittinger joked. “I was amazed that you could use very simple ingredients and come out with something much better than the mass-produced beers. I remember when the violent fermentation kicked in for my first batch, and I was like, ‘this is really happening.’”

Hittinger’s early fascination blossomed into a fairly serious hobby. Over the past 25 years, he’s brewed nearly 100 ales and lagers. One of his creations, a Hefeweizendoppelbock — the product of a “happy accident” — won a silver medal at the Michigan State Fair. Hittinger even remodeled his whole garage specifically to accommodate brewing, complete with makeshift gadgetry and an upright freezer he turned into a fermentation chamber.

Hittinger said he typically decides on his next beer style based on his mood, but it tends to follow the changes in the seasons, a light refreshing ale in the summer for instance, and a darker lager in the winter. His favorite brews are German styles, each one using a different fermentation process or culture of yeast. He’s brewed spiced holiday beer to hand out to co-workers at Christmas parties and gifts them to friends, family and neighbors.

The satisfaction he gets from home brewing is not only in seeing the fruits of his labors enjoyed by others, but also in the challenge of taking on a new, more complex style.

“It can be enjoyed on so many levels,” Hittinger said. “It’s rewarding, it’s gratifying and it can be as complicated as you want to make it. It’s like cooking, you can basically do it by the book or do your own thing.”

Jeff Hittinger stirs a brew pot full of “wort,” a liquid infused with sugars extracted from malted grain. After boiling the mixture for about an hour, Hittinger added hops and adjuncts of ginger, honey, cinnamon and orange peel to flavor a special spiced holiday ale.

‘Brewing fills that need for us tool freaks. When you’re doing a lot of theoretical and computational research, you miss the hands-on piece, and it’s a long time until you see that payoff. The payoff with brewing is you’re making something that’s tangible. It’s these short-term victories and having it all come together into a final product.’

- Jeff Hittinger





The modern-day Trappist monk

One brewer taking a low-tech approach to the craft is computer scientist Dan Laney. Tinkering is in his blood — his father was a missile engineer at Vandenberg Air Force Base and dabbled in wine and beermaking. Laney recalls beer bottles exploding in the garage of their family home in Lompoc, California during one of his dad’s homebrew attempts.

Laney has made his own beer for the past seven years, forgoing the fancy fermentation tanks and appliances for a loose, low-key approach using mostly standard kitchen supplies — heavy cookware, perforated pizza pans and the like. When it comes to brewing, he considers himself less a scientist and more of a chef.

“I got into it for cheap,” Laney says. “I use pots and pans, I take a lot of notes and let things turn out naturally. My style is similar to how people brewed before refrigeration.”

During the warmer months, Laney keeps his house at about 80 degrees and ferments beer indoors. Because his process is non-refrigerated, he prefers Belgian beer styles, which derive their distinctive flavors from esters and phenols produced by Belgian yeast strains. These chemicals are particularly expressed at higher fermentation temperatures and are particularly present in the beers produced by Trappist monastery breweries.

He has a particular fondness for Saison, a “farmhouse” ale birthed in Belgium’s Wallonia region, which he brews in the late spring for sharing on hot summer days. So far, Laney has produced about a dozen beers, and is most proud of a Belgian dark strong ale that required homemade candy syrup and a “double decoction” mashing process.

“It’s a crazy thing to do,” Laney said. “It’s like making a thick oatmeal. But it came out good.”

After bottling his batch, Laney shares his homemade beer with co-workers and has donated some to Oktoberfest church fundraisers. He considers himself a “socially driven” brewer, rather than a hardcore one, as most of his experience revolves around family and visits to his brother and cousins in Lompoc, where they brew together under the name “Cousins’ Beers.”

LLNL computer scientist Dan Laney takes an old school, Trappist monk-like approach to brewing, using basic supplies and fermenting his beer at room temperature.



“For me it’s more about the family connection,” Laney says. “My brother, my cousin, we all hang out together and it’s more of a social thing. It’s one thing that still bonds us together. We brew double batches and I bring the fermenter home in the trunk, which makes for interesting driving.”

Earlier in 2020, Laney and his cousins brewed a clone of Pliny the Elder, a popular Russian River Brewing double IPA. During the COVID-19 lockdown, Laney and his cousin held a socially distant tasting of their Pliny clone. Both cousins found their beer delicious but slightly sweeter than the original.

‘Relax, Don’t Worry. Have a Home Brew’

Despite their radically differing brew styles, Laney and Hittinger have teamed up to brew together several times, using the same equipment but different yeast strains.

Loveland has done his own comparative research, challenging his girlfriend to blind taste-tests. One half of the batch he ferments is in a closet, while the other half he puts in his temperature-controlled fermenter.

“When I first got the chamber, everything I’d been reading said if you temperature-control, that’s the easiest way to significantly improve the quality of your beer. It’s going to taste a thousand times better,” Loveland said. “Being the skeptic that I am, I thought, ‘Am I really going to notice a difference?’ It turns out you 100 percent can.”



‘The fun of brewing is that there is always that chance element that can produce something different than you expect. I’ve found it often, but not always, results in happy accidents and tasty results.’

– Dan Laney

To keep up on the latest trends in craft brewing and learn the tricks of the trade, Loveland started an Instagram page devoted to home brewing, where he gathers advice from more experienced brewers. As far as tips for the brew-curious, Loveland says it’s best to keep expectations low at the beginning and absorb lessons learned from veteran brewers.

“Everybody’s first beer probably isn’t going to be the one that wins over everybody,” Loveland said. “The biggest thing is to persevere and know that every beer is going to be an exponential improvement over the last, whether it’s your efficiency in the brewing process, the actual flavor of the beer or your knowledge of how the different flavors interact with one another.”

Hittinger’s advice? Pick up a copy of “The Complete Joy of Home Brewing” and follow its creed: “Relax, Don’t Worry, Have a Home Brew.”

“You can make it as easy or as difficult as you want,” Hittinger said. “You don’t need a lot to start. You can make the kind of beer you want to; you can backward-engineer a beer you like, you can read books on organic chemistry, it’s really up to you.”

'LITTLE PROFESSOR'

BLOSSOMS

INTO
CHAMPION
FOR
OTHERS

By Steve Wampler

Christine Hartmann's life and the lives of others have been significantly changed by a chance conversation.

As she talked with a friend's daughter in 2015, she learned about some of the social and economic problems faced by millions of people worldwide who have intellectual or developmental differences, or disabilities.

Little did Hartmann know that her encounter would lead her to team up with another Lab employee, Sharon Bobbitt, to help found an employee resource group that recognizes the capabilities of people whose brains work differently — people who are neurodiverse. Or that she would learn things about herself that she had never imagined.

"My conversation with my friend's daughter led me to a whole group of new people and got me excited about helping people with intellectual differences," Hartmann said. "The surprise was that I wound up learning a lot about myself.

"Our conversation opened the door to all kinds of new opportunities. Suddenly, I saw new ways to help other people and to impact my community in ways that I couldn't have imagined. It totally changed my life."

A meeting with author John Elder Robison, who is autistic and has written several books ("Look Me in the Eye" and "Be Different") about his own experiences and those of his autistic son, hit close to home for Hartmann. He is a champion of the idea that neurological differences, such as autism, should be thought of as part of human diversity, instead of simply disabilities.

About a year ago, Robison brought Hartmann and others to SAP, a multinational business software company with offices in Menlo Park. The group eventually went out to dinner.

"As we were driving around," Hartmann said, "I was mulling over why I have spent so much time on neurodiversity and John said, 'Did you ever wonder if you have autistic traits and tendencies? There are some tests you can take to give you some information.'"

"That night I took some standard tests developed by a Cambridge University psychologist. I learned that my autism spectrum quotient was much more in line with adults with autism than with the control group. This was definitely new information to me. I wondered: 'Could I be neurodiverse?'"

Hartmann called her mother, who said she wasn't surprised by the test results. After an unusual birth, her mother was warned by their doctor that Christine was likely to have brain damage.

"My mother devised a variety of one-on-one methods to help me and instead of developing slowly, I became a 'little professor.' I learned to read when I was 2, read the encyclopedia at 3 and was assigning myself reports on topics of my choosing when I was in kindergarten.

"I spent my childhood amusing adults, but I was often lost when it came to making and keeping friends my age. I would talk endlessly about things that interested me, like ancient Egypt, dinosaurs and lasers. The kids around me only had a passing interest in those things and tended to ease away from our conversations," she recalled.

Christine Hartmann started painting 12 years ago as a way to have fun with her two sons (Ben and Max) and to clear her mind. Her sons didn't take to painting, but Hartmann did and she's stuck with it ever since. Painting gives her a new way to develop ideas by letting the story emerge from the image.

Photos by Julie Russell



'I believe art, science and mathematics are all part of a grand creative universe and can be great landing spots for 'little professors.' I think in pictures, so it's natural for me to paint what's in my mind.'

-Christine Hartmann

Hartmann remembers finding high school challenging, with her attempts at making friends not as fruitful as she would have liked.

"I missed the verbal and nonverbal cues that would have helped me enter and exit conversations gracefully and understand the social networks around me. To avoid bullying, I hid in the band or art room during lunch. I have now learned that people with autism tend to be socially rejected or neglected."

As she faced some of her problems, Hartmann took refuge in the arts.

"When I was in college, I remembered points in advanced math by recalling the shape of the flowers I drew in the margins of my notes, and today I draw pictures to understand what people are saying or what proposals are trying to convey."

Hartmann, 54, took up painting 12 years ago at the suggestion of a friend. When she and her husband, Greg, purchased a small ranch in Tehama County in 2015, they created an art studio on the second floor of their barn.

"I decided painting was something that I wanted to do for fun with my two boys (Ben and Max), but they didn't take to it," she said. "I kept going because I like it. Painting gives me a new way to develop ideas by letting the story emerge from the image instead of the other way around. This gives me the chance to think in a different way."

Hartmann finds it easy to paint the things she loves — such as her horse, her cats, cows or flowers — or simple things, such as plants. "I think there is a lot of beauty in simple things."

"I also like to paint things as I wish they could be. We want more peace and happiness. Sometimes our old stories won't get us there. We need to think in new ways."

Painting helps me clear my mind so that I can think in new ways."

Hartmann's self-discovery of her learning differences encouraged her to help others with similar challenges.

Her friend's daughter told Hartmann about her work for Best Buddies, an organization founded by Anthony Kennedy Shiver and dedicated to assisting people with intellectual and developmental disabilities.

Soon Hartmann learned that only about 44 percent of adults with intellectual disabilities are in the labor force. Only about 20 percent of young adults with developmental disabilities, such as autism, work full-time, and their pay is about \$8 an hour.

"I couldn't help but think about my own life and the richness of the opportunities I've been afforded, compared to the situations that she described to me."

Putting feet to her ideas, Hartmann spoke with Tony Baylis, the director of the Lab's Strategic Diversity and Inclusion Office, about how Best Buddies might connect with possible internship opportunities at LLNL.

Baylis suggested another approach. He recommended that Hartmann join forces with Bobbitt, who several years earlier had started an internship program with Concord-based Orion Academy, one of the few high schools in the nation to serve students with high-functioning autism. In the early days, from 2014-16, one or two Orion students successfully completed short internships at LLNL each year.

It turned out that Bobbitt, a group leader for compliance in the Lab's Office of the Chief Financial Officer, and Hartmann, the head of the Lab's Program Development Support Office, made an

When Christine Hartmann and her husband, Greg, purchased a small ranch in Tehama County, they created this small art studio on the second floor of their barn. Hartmann finds it easy to paint the things she loves — such as her horse, her cats, cows or flowers — or simple things, such as plants.



ideal team. Bobbitt laid the foundation for the Lab to host neurodiverse interns and Hartmann provided an institutional perspective on how to get things done.

"Sharon's been the driving force to bring neurodiverse interns to the Laboratory. She really is a champion of neurodiversity and I truly admire her," Hartmann said. "She put together a whole team from Engineering, the Lab's Strategic Human Resources Management and other areas of the Lab that are interested in bringing neurodiverse students to the Lab and helping them be successful."

In 2017, with support from Susan Lowder of the Lab's Strategic Human Resources Management, Brian Giera of Engineering and others, Hartmann and Bobbitt helped found the Abilities Champions Employee Resource Group (ERG) to assist neurodiverse students.

Today, the Abilities Champions ERG has about 20 members and is led by Chris Campbell, a group leader in the Environmental Safety and Health Department.

In Bobbitt's view, Hartmann "brought the vision and the magic" so that the team could be transformed into an employee resource group.

"Christine expanded our thinking. She became our chair. She helped us think about having booths at events. She guided us to work with the Livermore Employee Services Association and bring in speakers. We went to conferences where neurodiversity in the workplace was discussed. Christine is a catalyst, very creative and she makes things happen," Bobbitt added.



Each year, the Abilities Champions organize internships for about 10 to 20 neurodiverse students, hosting 18 interns in 2019 and about 10 in 2020, due in part to reduced workers on-site because of COVID-19.

Two of the 2019 interns worked for Hartmann in the Lab's Program Development Support Office (PDSO). "I think this was a great opportunity for these interns to learn about the workplace. They performed important work that was helpful to Lab programs, including PDSO."

"We start working with our interns really early," Hartmann said. "We engage many students in high school and follow them through college. Our first interns are now in college, with many of them pursuing degrees that are very relevant to LLNL. This internship program has been a labor of love for many members of our ERG and mentors around the Lab, and I believe it is changing people's lives."

In 2019, the Abilities Champions hosted a celebration of neurodiversity at LLNL, bringing in a panel of experts, including Stanford University professor Lawrence Fung, researchers from the University of California, Davis M.I.N.D. Institute and Robison, who helped Hartmann learn about her own neurodiversity.

Just as Hartmann has found art and painting to be a refuge, she believes internships at the Lab for neurodiverse students can be a win-win situation for the students and the Lab.



Born to sing

By Madeline Burchard

To say Saptarshi Mukherjee comes from a musical family might be a bit of an understatement. Nearly everyone in his immediate family is trained in a musical discipline whether it is singing, playing an instrument or both. Growing up, music was an ever-present part of his life.

"I was pretty much being trained as soon as I was born," Mukherjee said. "I was trained by amazing musical gurus, including my own father."

As he grew up, he began focusing less on his musical training and more on his academics. When he enrolled in a rigorous university engineering program, his musical training was moved completely to the backburner, much to the disappointment of his family.

"My father was not happy," Mukherjee said. "He would keep alluding to the fact that not continuing my training is deteriorating my singing abilities."

Coming to America

In 2013, Mukherjee came to the United States to enter the electrical engineering Ph.D. program at Michigan State University. Ironically, it took leaving India to reignite his passion for classical Indian music. Feeling homesick, he started looking for teachers in or near East Lansing that could help him restart his training. When he found none, he searched for and found an online training run by a major maestro in India (Shankar Mahadevan Academy). After his first training course, he faced his fears and performed in public for the first time in the U.S.

"I finally gathered up the courage to perform and did 10 minutes of classical music. It felt divine." It wasn't just Mukherjee that was finding joy. His



father was ecstatic when he learned his son was returning to his musical roots.

"I send him a lot of recordings. He is very encouraging of me and motivates me to never give up."

More than music

"When I perform, I'm not just singing," Mukherjee said. "I am connecting to a tradition and legacy that are thousands of years old."

Classical Indian music is unique in its use of melodic frameworks called ragas. Ragas have no direct equivalent in European classical music but can be likened to scales. Each raga is symbolic and denotes a specific mood, atmosphere, emotion or even time of day. Presently, classical Indian musicians use hundreds of different ragas, but theoretically thousands of ragas exist.

"Ragas give Indian classical music an enormous complexity, diversity and richness," Mukherjee said.

Finding community

In 2018, Mukherjee joined the Laboratory as a postdoctoral researcher in the Computational Geosciences Group within the Atmospheric, Earth and Energy Division. It didn't take long to connect with the San Francisco Bay Area's vibrant Indian arts community.

"As the news of my classical training spread in the community, I began receiving invites to perform at Indian festivals and concerts," Mukherjee said. "I even entered Voice of Bay Area, an Indian singing competition and reached the semi-finals."

Saptarshi Mukherjee performs for an online audience as part of his classical Indian singing studies. After the pandemic, he hopes to return to performing at arts festivals and community gatherings.

Photos by Garry McLeod



‘When you cultivate a creative hobby, you are using a different part of your brain. I like to think this has helped me better approach problems and projects at the Lab.’

- Saptarshi Mukherjee

Mukherjee has been playing music nearly since birth. In addition to being a trained singer, he also plays a variety of instruments, including the piano.

Finding harmony

In addition to being an artistic passion, Mukherjee also sees his singing as critical to his work and career. He says cultivating his art helps him destress and come to his work refreshed and more innovative.

Mukherjee is not alone in crediting music for helping his science. Research has found that having a creative hobby is correlated with scientific success. A study from Michigan State University found that Nobel Prize winning scientists are 2.85 times more likely to have an artistic hobby or craft. While it is unknown if there is a causal link, some propose that the arts can act as a form of mental cross-training.

In addition to the mental benefits, Mukherjee credits his singing with helping his career. His experience performing in front of crowds has helped him prepare for public speaking and presentations at the Lab.

“Whether it is a Laboratory Directed Research and Development panel or just a presentation, I know how to improvise in the moment and I speak and act with more comfort and confidence,” he said.

Singing in the time of COVID

While the COVID-19 pandemic has led to canceled festivals and concerts, Mukherjee is still finding opportunity. After all, he is well seasoned in taking advantage of online learning. These days he is adding a new art to his repertoire — composing.

“In addition to continuing to improve my singing, I am learning how to write my own songs and music,” he said. “Classical Indian music is very rich and complex, but I know that if I am persistent and make the time, I can get there.”

Mukherjee also wants to do more to share his art with others who may not know about classical Indian music. Recently he has started creating original video content for his [YouTube channel](#) and social media.

“At the Lab there are a lot of people who are not familiar with Indian music. I think it is an amazing genre that anyone can learn from and enjoy,” Mukherjee said. “If it brings me joy, I know it can do the same for others.”



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